United States Patent [19]

Grosswendt et al.

[11] **Patent Number: 4,889,030**

[45] **Date of Patent: Dec. 26, 1989**

[54] **PROJECTILE EQUIPPED WITH DEPLOYABLE PARACHUTE**

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[21] Appl. No.: **254,680**

[22] PCT Filed: **Nov. 5, 1987**

[86] PCT No.: **PCT/EP87/00674**

§ 371 Date: **Sep. 22, 1988**

§ 102(e) Date: **Sep. 22, 1988**

[87] PCT Pub. No.: **WO88/05523**

PCT Pub. Date: **Jul. 28, 1988**

[30] **Foreign Application Priority Data**

Jan. 22, 1987 [DE] Fed. Rep. of Germany 3701709

[51] **Int. Cl.**[4] **F42B 13/38**

[52] **U.S. Cl.** **89/1.14**; 102/378; 102/387

[58] **Field of Search** 89/1.14; 102/340, 378, 102/377, 387

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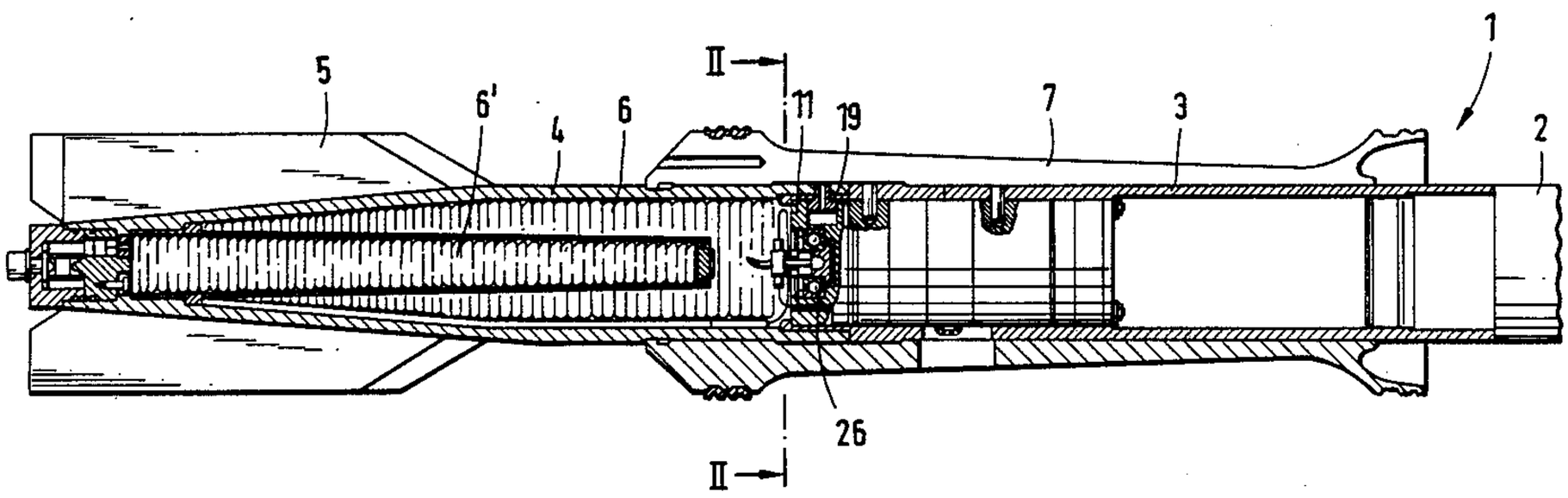
Primary Examiner—David H. Brown
Attorney, Agent, or Firm—Spencer & Frank

[57] **ABSTRACT**

A projectile has at two parts (**3, 4**) axially arranged one behind the other and mutually linked, of which at least one contains a deployable parachute (**6, 6'**). In order to achieve a design that ensures a smooth and reliable separation of the parts (**3, 4**), followed by the deployment of the parachute (**6, 6'**), both parts (**3, 4**) are mutually linked by radial bolts (**19**) that can be radially actuated by the gas pressure generated by at least one pyrotechnic load (**15**) and radially moved by the gas pressure, thus separating the two parts (**3, 4**). The pyrotechnic load (**15**) can be ignited by a fuse (**9**).

18 Claims, 5 Drawing Sheets



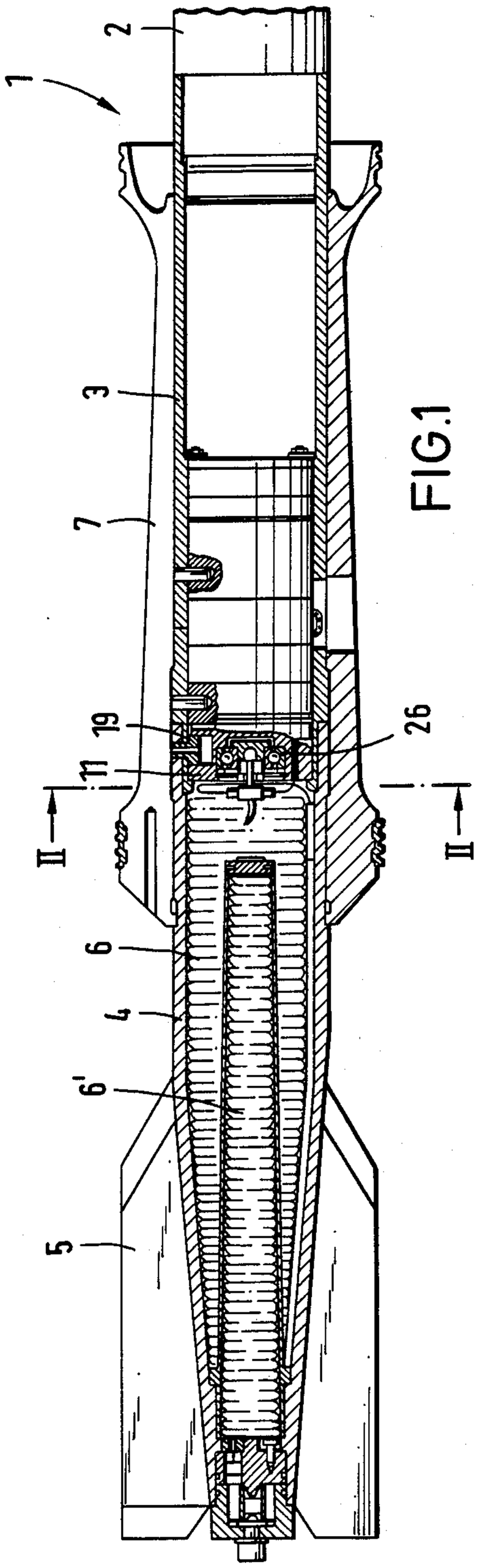


FIG.1

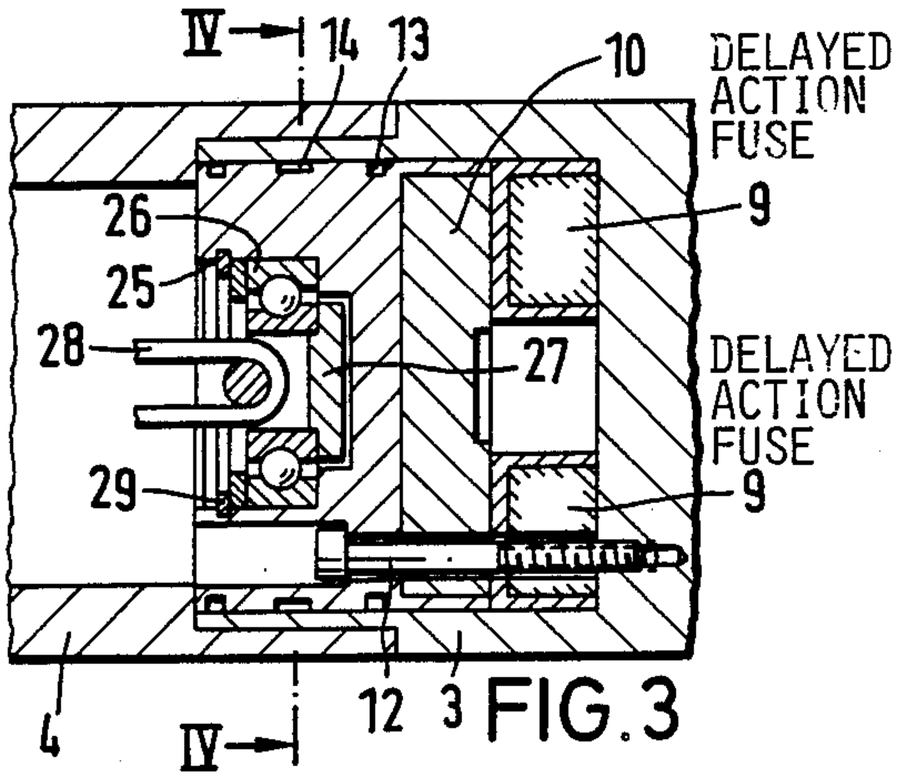


FIG.3

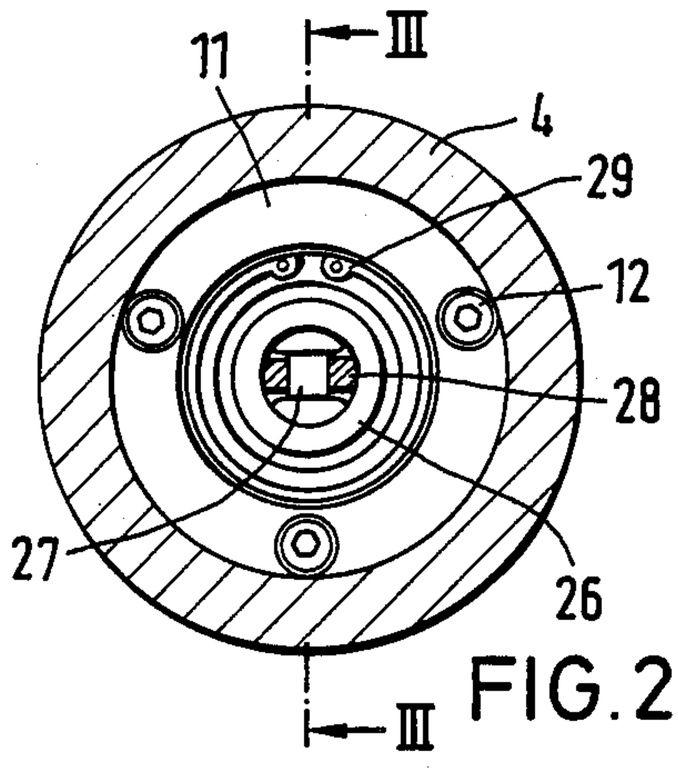
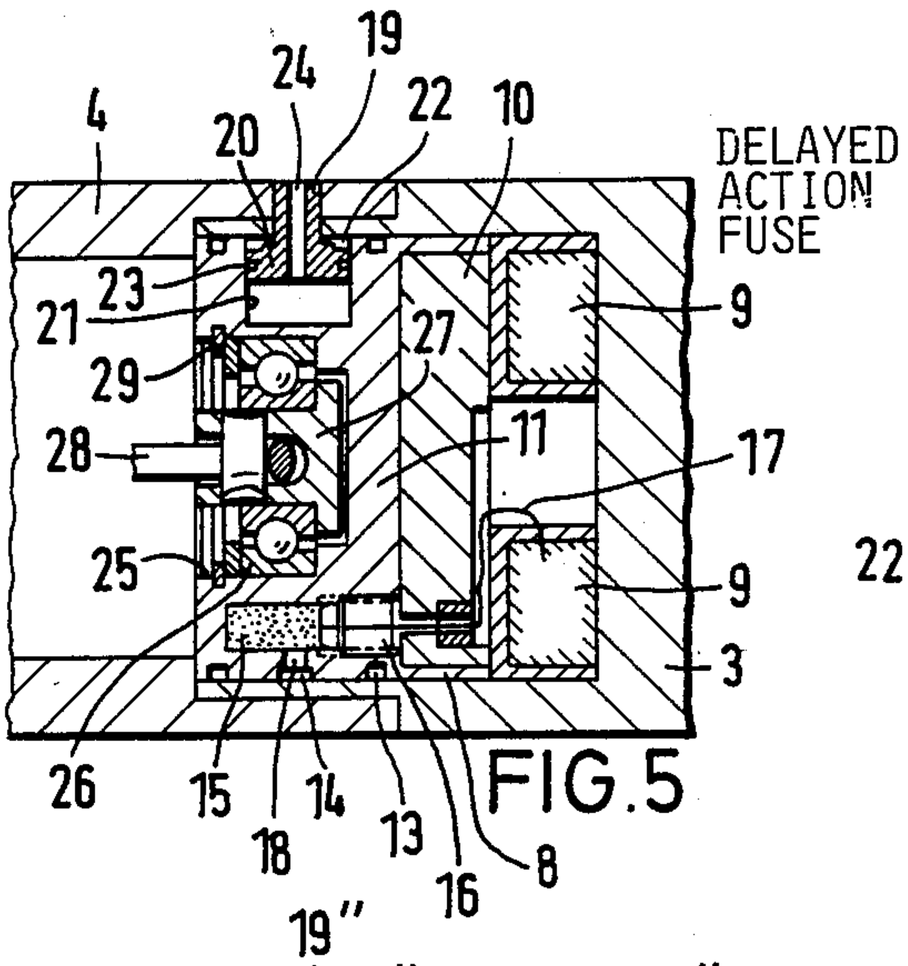


FIG.2



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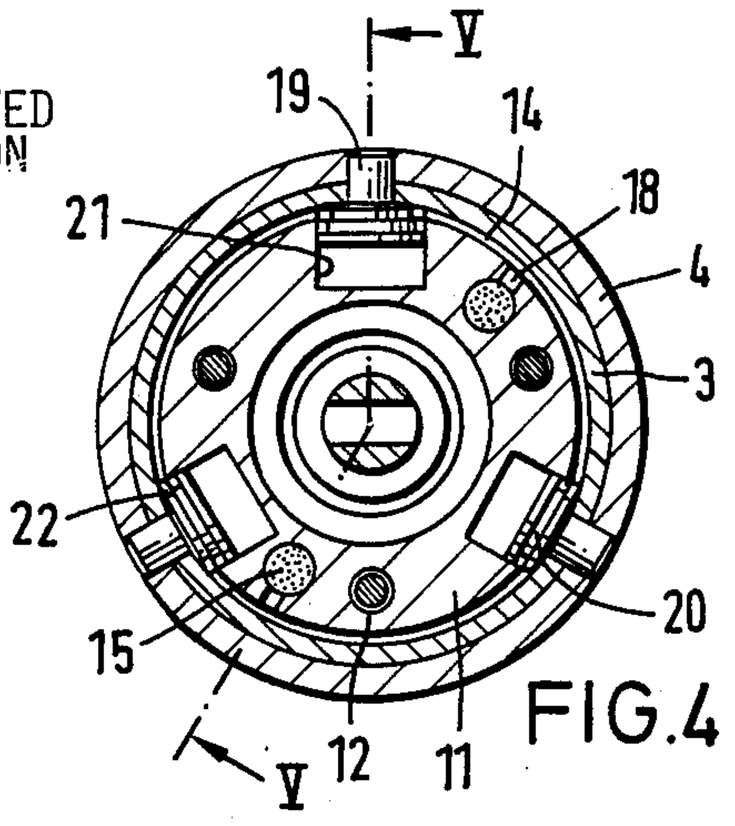

FIG.4

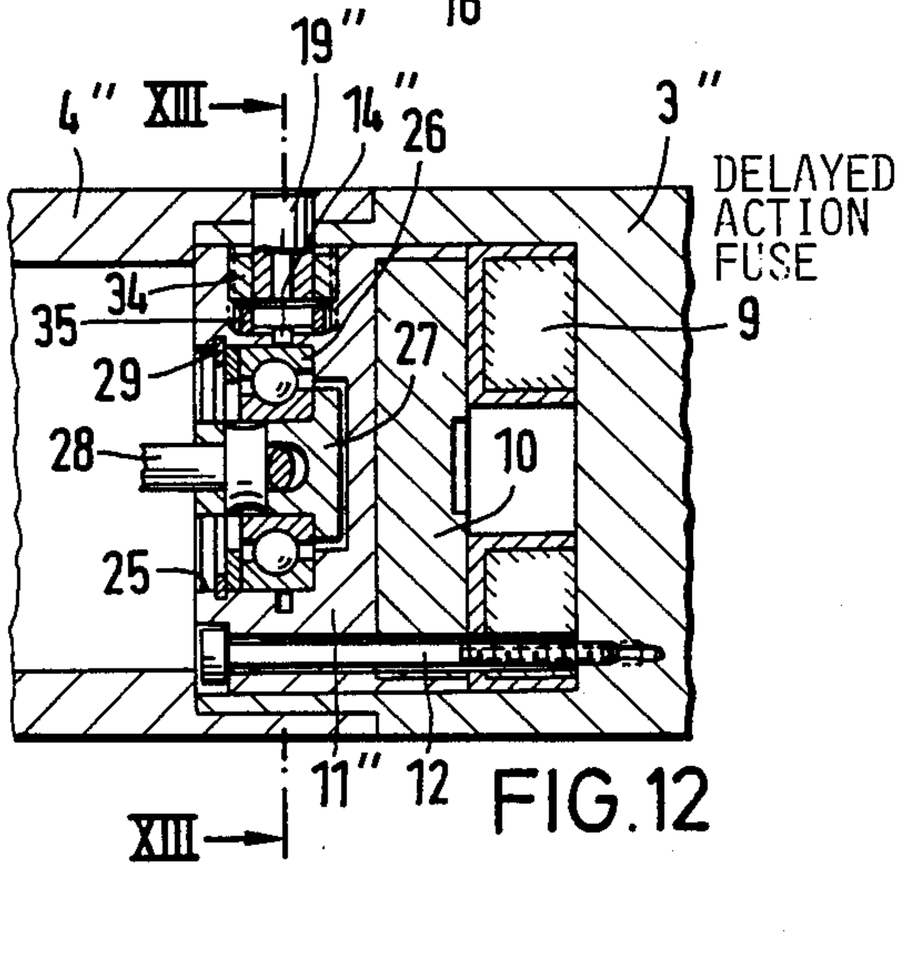

FIG.12

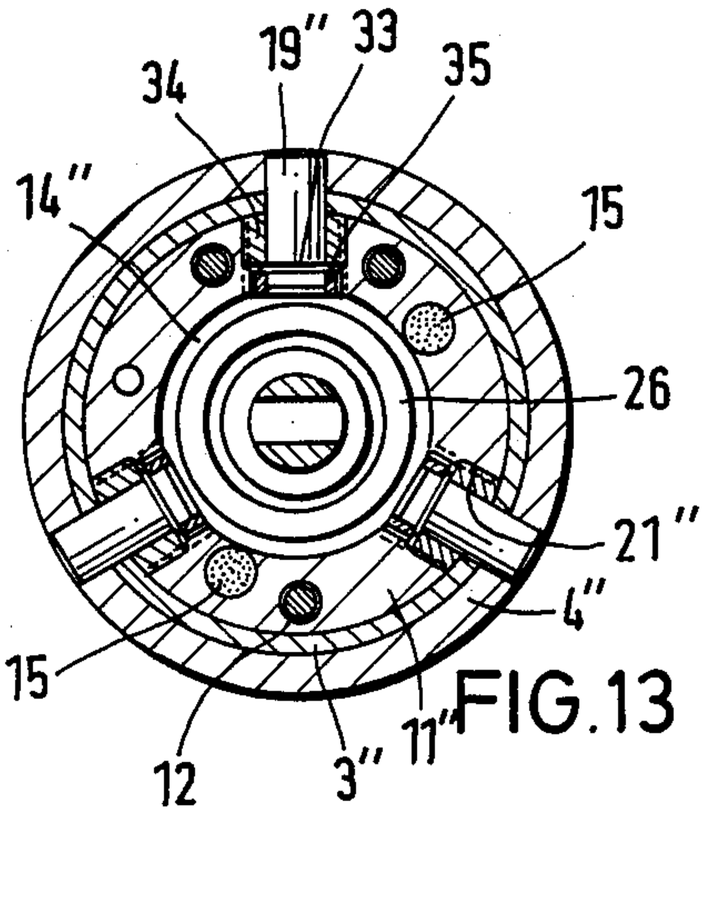

FIG.13

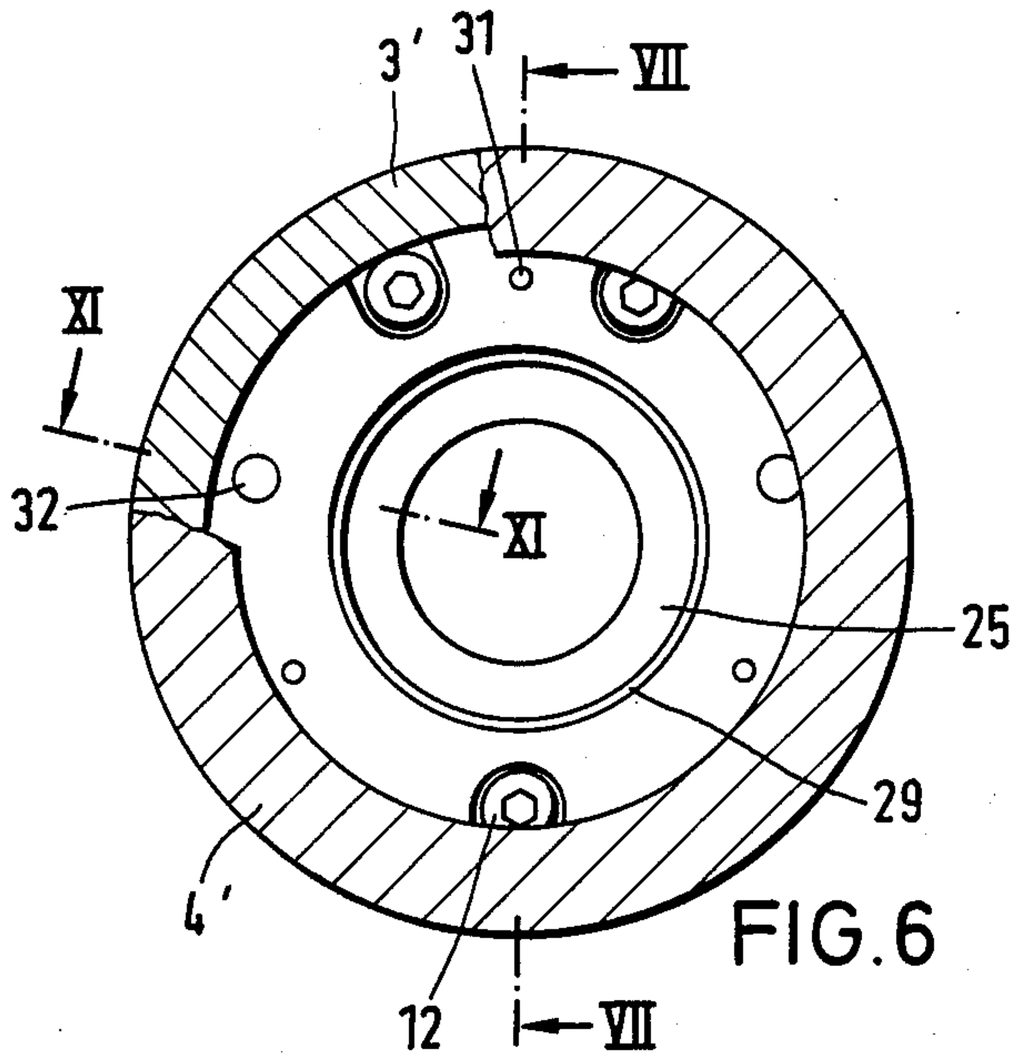
3'
31
VII
XI
32
XI
25
29
4'
12
VII

FIG.6

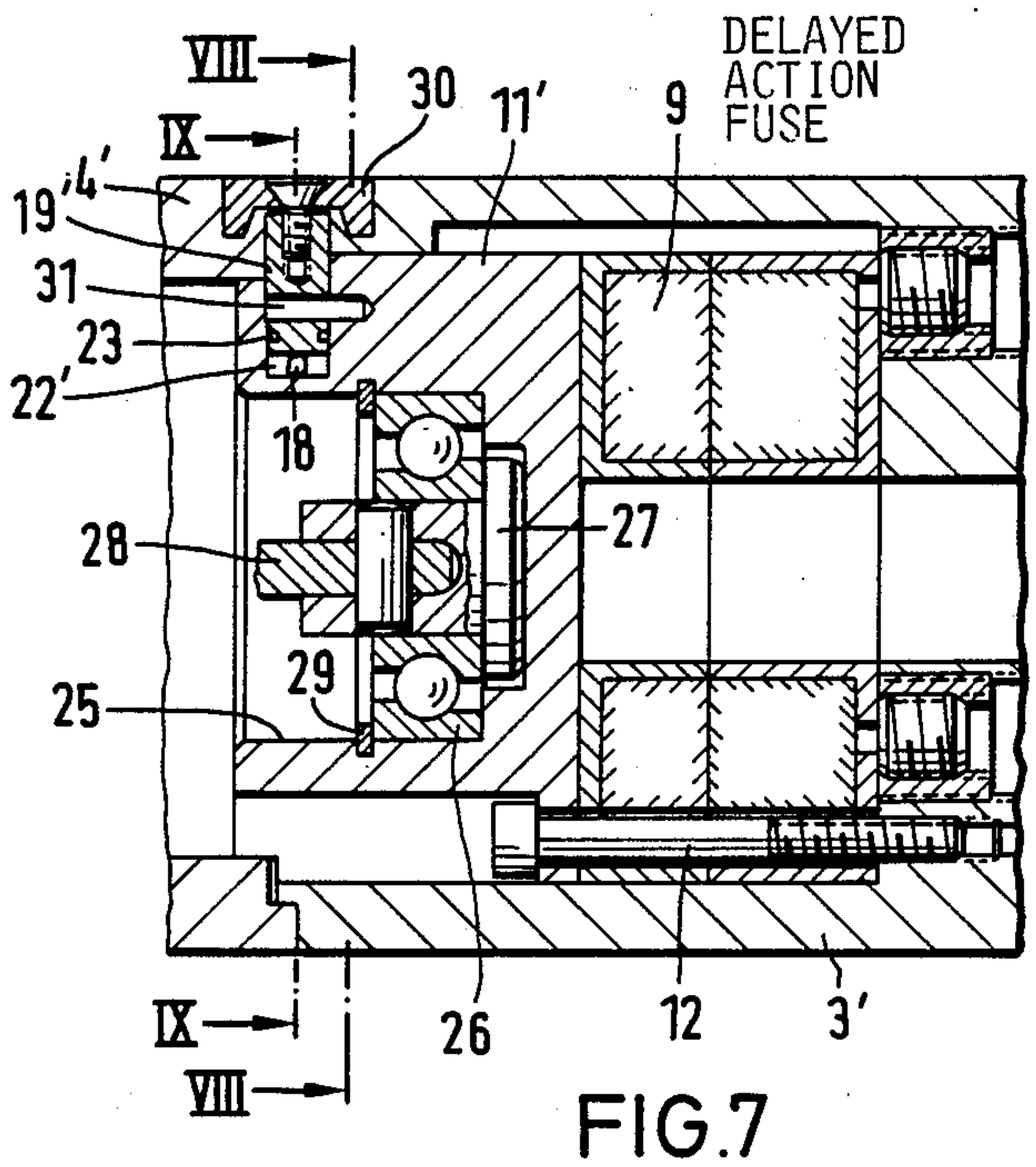
VIII
IX
30
11'
9
DELAYED ACTION FUSE
4'
19
31
23
22'
18
28
29
25
27
26
12
3'
IX
VIII

FIG.7

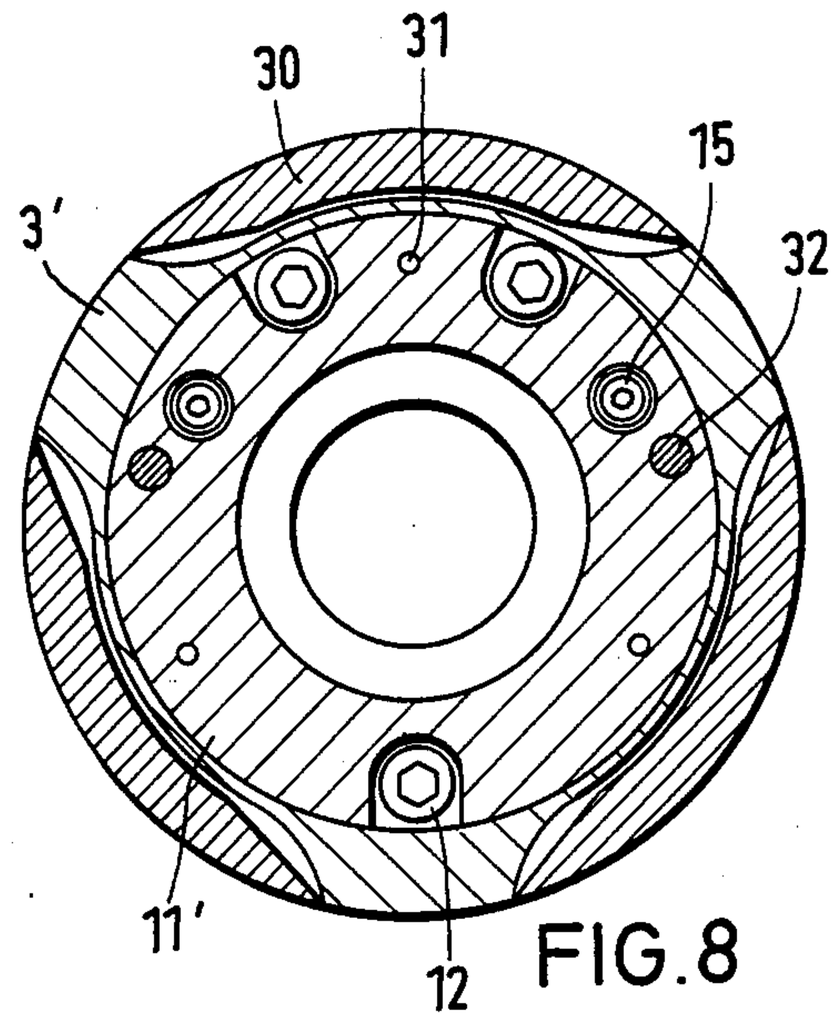

FIG.8

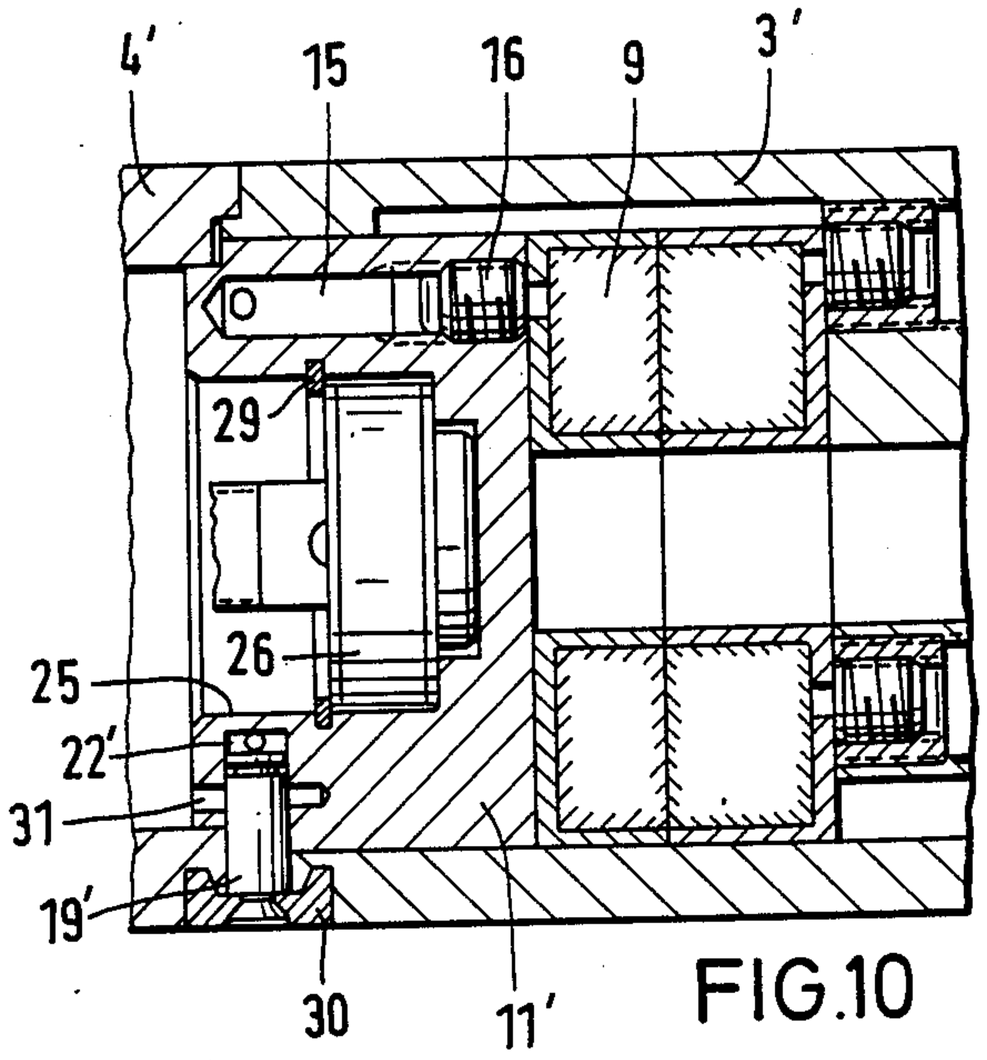

FIG.10

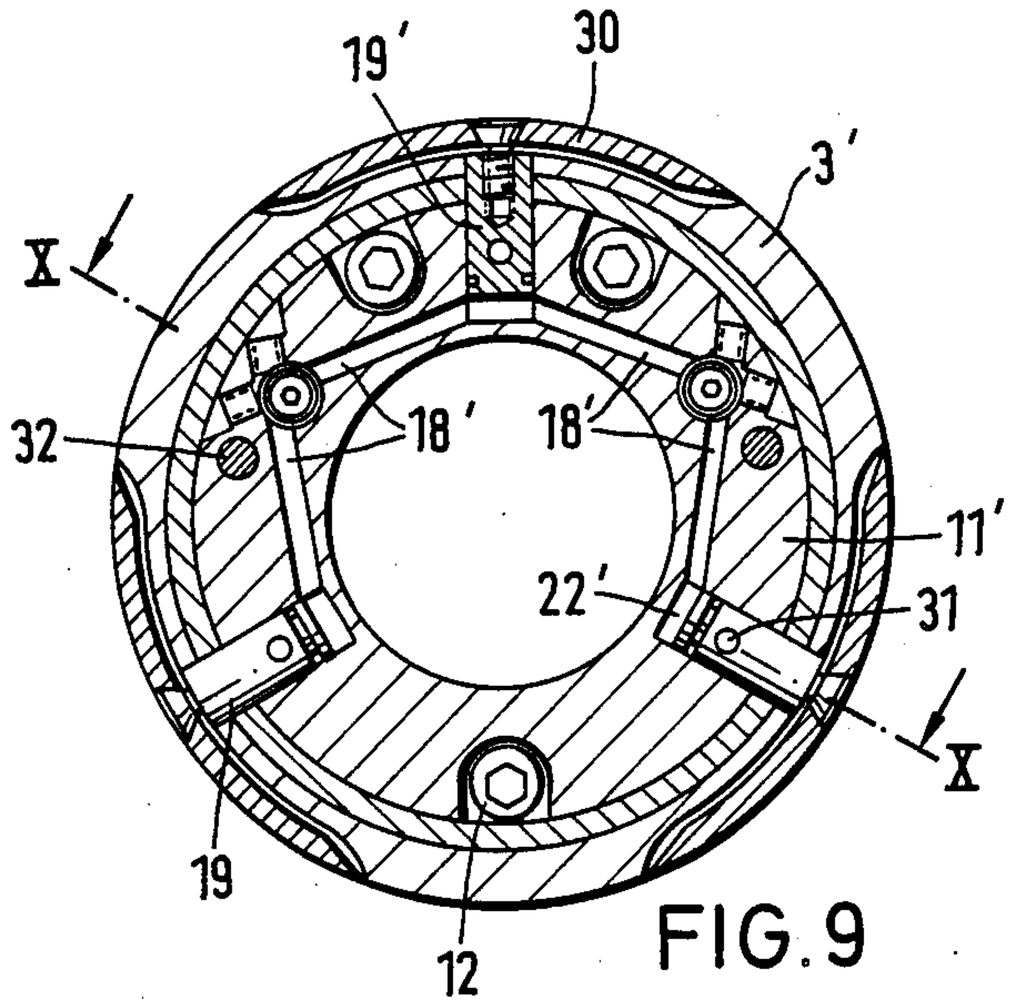

FIG. 9

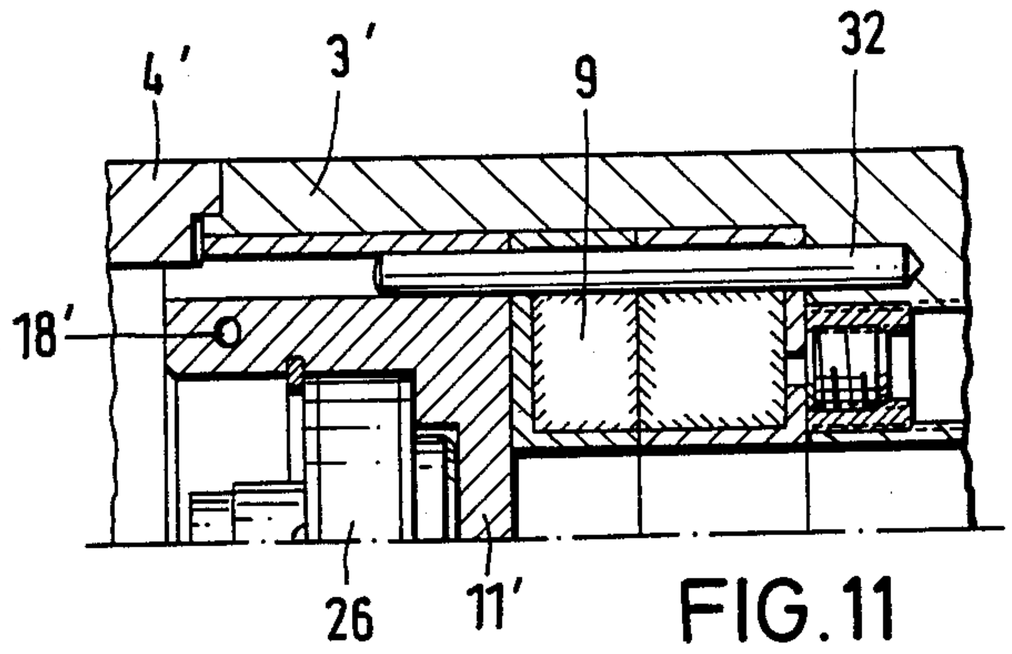

FIG. 11

PROJECTILE EQUIPPED WITH DEPLOYABLE PARACHUTE

BACKGROUND OF THE INVENTION

The invention relates to a projectile equipped with a deployable parachute. More particularly, the present invention relates to such a projectile which is composed of at least two sections arranged axially in tandem and connected with one another by means of radially extending bolts, and with one of the sections accommodating the parachute.

One possibility of recovering projectiles undamaged after firing is to decelerate the flying velocity of the projectile or of its components to acceptable ground impact values with the aid of a parachute. A parachute can also be employed to cause the projectile tip to penetrate into the ground.

To cause the parachute to become effective, it must be ejected on the trajectory or the projectile must be separated in such a way that the parachute is able to automatically deploy as a result of the streaming air.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a projectile having a deployable parachute, with such a projectile being of the type mentioned above with two axially tandem sections connected by radial bolts and having a simple structure and permitting reliable separation for deployment of the parachute.

This object is accomplished according to the invention by a projectile of the above described type wherein the radial bolts are radially chargeable by the gas pressure so as to separate the two sections, with the pyrotechnic charge being burnt off or ignited by way of a fuse.

Further features of the invention are to be found in the description below and in the dependent claims.

The invention will be described below in greater detail with reference to embodiments that are illustrated in the attached drawing figures.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a longitudinal sectional view of a projectile equipped with one embodiment of a separating device.

FIG. **2** is a cross-sectional view of the separating device along line II—II of FIG. **1**.

FIG. **3** is a longitudinal sectional view along line III—III of FIG. **2**.

FIG. **4** is a cross-sectional view along line IV—IV of FIG. **3**.

FIG. **5** is a longitudinal sectional view along line V—V of FIG. **4**.

FIG. **6** is a partial cross-sectional rear view of a further embodiment of a separating device.

FIG. **7** is a longitudinal sectional view along line VII—VII of FIG. **6**.

FIGS. **8** to **11** are sectional views corresponding to lines VIII—VIII to XI—XI of FIGS. **6**, **7**, **8** and **9**.

FIG. **12** is a longitudinal sectional view of an additional embodiment of a separating device.

FIG. **13** is a sectional view along line XIII—XIII of FIG. **12**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the embodiment shown in FIGS. **1** to **5**, a projectile **1** is composed of a nose section **2**, a center section **3** and a tail section **4**, with tail section **4** being equipped with fins **5** and accommodating two parachutes **6**, **6'**. Also provided is a propelling cage **7** which extends essentially over the center section **3** and part of the tail section **4** and is discarded upon firing after it has left the gun barrel.

Center section **3** is provided at its rear with a coaxial cylindrical recess **8** at whose bottom two delayed-action fuses **9** are disposed which are covered by means of a plate **10**. Recess **8** is closed by an insert **11** which simultaneously accommodates plate **10** and is connected with center section **3** by means of screws **12** extending in the axial direction. On its circumference, insert **11** is sealed against center section **3** by circumferential seals **13** between which there is disposed an annular, circumferential channel **14**.

In corresponding blind bores in insert **11**, a pyrotechnic charge **15** and a flame capsule **16** are inserted from the side facing plate **10** in two diametrally oppositely disposed positions, the flame capsule **16** being connected by way of conduits **17** extending through plate **10** with the associated delayed-action fuses **9** so that flame capsules **16** can be ignited by delayed-action fuses **9**. Gas conducting channels **18** extend from the region of the blind bores accommodating the pyrotechnic charge **15** to the annular channel **14**.

Moreover, three bolts **19** are provided which are equipped with pistons **20** at their rear sides and are received in radial bores **21** in insert **11** which are distributed equidistantly over the circumference of insert **11** in the region between the two seals **13**. In the region of insert **11**, the outer diameter of center section **3** is reduced while tail section **4** has a correspondingly enlarged inner diameter to be able to receive the end of center section **3**. In the telescoped state of center section **3** and tail section **4**, both sections are provided with bores which are coaxial in the overlapping region and through which bolts **19** extend up to the outer circumference of tail section **4** so as to connect center section **3** and tail section **4** with one another, while a gas pressure chamber **22** exists between the interior of center section **3** and the oppositely disposed side of piston **20**, which is disposed in the region of channel **14**.

Piston **20** may be provided with a circumferential seal **23** while bolt **19** may be provided with an axial bore **24** which permits easy positioning of bolts **19** during assembly.

Additionally, insert **11** is provided with a recess **25** to accommodate a bearing **26** whose inner ring is connected with an eye **27** which is thus movable and receives a loop **28** of parachute **6**. Bearing **26** is secured in insert **11** by a spring ring **29**.

If, after firing of projectile **1**, parachute **6** is to be deployed, flame capsules **16** are ignited by delayed-action fuses **9** thus causing the pyrotechnic charges **15** to burn off. The gases developed thereby travel through gas conducting channels **18** into annular channel **14** and thus charge the pistons **20** of bolts **19** from the circumferential side by way of gas pressure chamber **22**. This causes pistons **20** and thus bolts **19** to be pressed radially inwardly so that they go out of engagement with respect to tail section **4** and the latter is separated from center section **3**. Thus parachute **6** which is fastened to center section **3** is released by way of insert **11** and is able to be deployed. Tail section **4** is decelerated by the second parachute **6'** whose deployment is also effected by the separation.

In the embodiment shown in FIGS. **6** to **11**, center section **3'** and tail section **4'** are connected with one another by means of clamps **30**. Clamps **30** are screwed to bolts **19'** which, in turn, are held in insert **11'** by axial shear pins **31**. Gas conducting channels **18'** open into gas pressure chamber **22'** between the bottom of bore **21'** and the interior of bolt **19'** so that the gases generated by the pyrotechnic charges **15** charge bolts **19'** from the inside and press them outwardly thus causing shear pins **31** to be sheared off and clamps **30** to be thrown off so that center section **3'** and tail section **4'** are separated.

Adjacent gas pressure chamber **22'**, bolts **19'** may be provided with a circumferential seal **23'**. Delayed-action fuses **9** may be held by means of pins **32** between insert **11'** and center section **3'**.

In principle bolts **19'** which, according to the second embodiment, are secured by shear pins and can be pressed outwardly, can also be used in the first embodiment.

In the embodiment shown in FIGS. **12** and **13**, shear pins **31** are replaced by shear discs **33** which are held by a two-part bolt **19''**. Bores **21''** are designed as threaded bores and receive a threaded ring **34** which supports shear disc **33** toward the exterior and surrounds bolt **19''**. Between shear disc **33** and the bottom of bore **21''**, a ring **35** is inserted which surrounds bolt **19''** so that the gases released by pyrotechnic charges **15** act only on the interior frontal faces of bolts **19''**.

An annular channel **14''** is here provided at the interior of recess **15''** and is closed toward the outside by bearing **26**. Channel **14''** is in communication with bores **21''** and with the bores accommodating pyrotechnic charges **15** so that the inner frontal faces of bolts **19''** are charged directly by the gas pressure from the combustion of pyrotechnic charges **15** through channel **14''**.

We claim:

1. In a projectile including at least two sections arranged axially in tandem, a plurality of radial bolts disposed in respective radially extending bores connecting said two sections together, means, disposed in said projectile and including a pyrotechnic charge and a fuse for causing ignition of said charge, for producing a gas pressure for radially displacing said bolts to release the connection between and separate said two sections of said projectile, and at least one deployable parachute accommodated in one of said two sections; the improvement wherein said means for generating a gas pressure for radially displacing said bolts include gas conducting channels leading from said pyrotechnic charge to said radial bores to directly apply said gas pressure to a respective frontal face of each of said plurality of bolts which is to be charged with gas pressure.

2. Projectile according to claim **1** wherein said pyrotechnic charge is ignited by a flame capsule disposed in the projectile adjacent the charge.

3. Projectile according to claim **1**, wherein said fuses are delayed-action fuses.

4. A projectile according to claim **1** wherein said bolts are displaceable radially inwardly by the gas pressure and are provided with larger diameter piston portions at their interior ends; and said gas conducting channels open into said bores exteriorly of the respective exterior frontal faces of said piston portions which are charged by the gas pressure from the exterior.

5. Projectile according to claim **1** wherein one of said two sections accommodates an insert which is provided with said radial bores for the bolts and accommodates said pyrotechnic charge and said gas conducting channels which lead from the pyrotechnic charge to the respective frontal faces of the bolts which are to be charged with gas pressure.

6. A projectile as defined in claim **5** wherein: said one section accommodating said parachute is a tail section of said projectile; said insert is fastened to the second of said two connected sections at its rear; and said parachute is connected to said insert.

7. Projectile according to claim **5** wherein said insert is disposed in the second of said two connected sections and is connected with said parachute by an eye.

8. Projectile according to claim **7**, wherein said insert accommodates a bearing by which the eye is held rotatable relative to the insert.

9. Projectile according to claim **5** wherein: said bolts are displaceable radially inwardly by the gas pressure and are provided with larger diameter piston portions at their interior ends; and said gas conducting channels open into said bores exteriorly of the respective exterior frontal faces of said piston portions which are charged by the gas pressure from the exterior.

10. Projectile according to claim **9**, wherein said gas conducting channels include an annular channel disposed on the exterior circumference of said insert with said annular channel opening into said bores adjacent to the outwardly oriented frontal face of the respective piston portions and being connected with further gas conducting channels which open into the region containing the pyrotechnic charge.

11. Projectile according to claim **9**, wherein said bolts are provided with axial passage openings.

12. Projectile according to claim **1** wherein: said bolts can be displaced radially outwardly by the gas pressure; said gas conducting channels open into said bores so that the respective interior frontal faces of said bolts can be charged with gas pressure; and said bolts are secured by shear means.

13. Projectile according to claim **12**, wherein said shear means are axial shear pins.

14. Projectile according to claim **12**, wherein: said one section is the tail section of said projectile; each bolt is screwed to a clamp which connects the other section with the tail section; and said clamps are releasable from the other section and from the tail section by the radial displacement of the bolt toward the outside.

15. Projectile according to claim **12**, wherein said shear means are shear discs.

16. Projectile according to claim **15**, wherein said shear discs are held by said bolts which are two-part bolts.

17. Projectile according to claim **15**, wherein said bores are configured as threaded bores and each receives a threaded ring which supports the shear disc toward the exterior.

18. Projectile according to claim **15** wherein a ring which surrounds the respective bolt is inserted between the bottom of each bore and the respective shear disc, with the gas conducting channels opening within the ring into the space between the bolts and the bottom of respective bore.

* * * * *